

In the Claims:

1. An autoregressive model learning device that sequentially reads the data string of the real number vector values and learns the probability distribution for generation of said data string using the autoregressive model comprising:

a data updating device that updates the sufficient statistic of the autoregressive model with forgetting the past data using newly read data and a parameter calculator that reads the sufficient statistic updated by said data updating device and calculates the parameter of the autoregressive model using the sufficient statistic.

2. An outlier and change point detection device that calculates the outlier score and the change point score for the data described with the sequentially input discrete variate and/or continuous variate so as to detect the outlier and the change point comprising:

a first model learning device that learns the generation mechanism for the read data series as the time-series statistic model specified by the finite number of parameters, and

an outlier score calculator that reads the value of the parameters obtained through learning by said first model learning device, calculates the outlier

score of the data based on the read parameter of the
time-series model and the input data and outputs the
15 results.

3. An outlier and change point detection device as
set forth in claim 2, further comprising
as a detection device to detect the change point,
a moving average calculator that sequentially
5 reads the outlier scores calculated by said outlier
score calculator and calculates their moving average,
a second model learning device that sequentially
reads the moving average of the outlier scores
calculated by said moving average calculator and learns
10 the generation mechanism for the moving average series
in the read score as a time-series statistic model
specified by the finite number of parameters, and
a change point score calculator that reads the
parameter value obtained by learning by said second
15 model learning device and calculates the outlier score
for each moving average based on the read parameter of
the time-series model and the moving average of the
input outlier scores and outputs the outlier score for
each moving average as the change point score of the
20 original data.

4. An outlier and change point detection device as
set forth in claim 3, wherein

said first model learning device learns, in case the sequentially input data are described with
5 continuous variate only, the probability distribution for generation of said data string with sequentially reading the data strings of the real number vector values using the autoregressive model and further comprises a data updating device to update the
10 sufficient statistic of the autoregressive model with forgetting the past data using the newly read data and a parameter calculator to read the sufficient statistic updated by said data updating device and to calculate the parameter of the autoregressive model using the
15 sufficient statistic.

5. An outlier and change point detection device as set forth in claim 3, wherein

said outlier score calculator and said change point score calculator are considered as a single score
5 calculator, further comprising as a device to determine the candidates of outliers and change points in the series for the data series described in discrete and/or continuous variates, a sort device to sort the data in descending order based on the outlier score and the
10 change point score calculated by said score calculator and the display device that displays the data with higher scores according to the order sorted by said sort device as the candidates of outliers and change points.

6. An outlier and change point detection device as set forth in claim 3, wherein

said outlier score calculator and said change point score calculator are considered as a single score calculator, further comprising, as a device to determine
5 candidates of outliers and change points in the series for the data described in discrete and/or continuous variates sequentially input, a score judgement device that outputs the data over the predetermined threshold
10 from the outlier score and the change point score calculated by said score calculator as the candidates of outliers or change points.

7. An autoregressive model learning method in which the data string of the real number vector values are sequentially read and the probability distribution for generation of said data string is learned using the
5 autoregressive model, comprising the steps of:

a data updating step of updating the sufficient statistic of the autoregressive model with forgetting the past data using newly read data, and

a parameter calculation step of reading the
10 sufficient statistic updated by said data updating step and calculating the parameter of the autoregressive model using the sufficient statistic.

8. An outlier and change point detection method to detect the outlier and change point by calculating the outlier score and the change point score for the data described with the sequentially input discrete variate and/or continuous variate, comprising the steps of:

a learning step of learning the mechanism to generate the read data series as a time-series statistic model specified by the finite number of parameters, and

an outlier score calculation step of reading the parameter value obtained through learning by said learning step and calculating the outlier score of each data based on the read parameter of the time-series model and the input data and outputting the results.

9. An outlier and change point detection method as set forth in claim 8, wherein

said method to detect the change point further comprises

a moving average calculation step of sequentially reading the outlier score calculated by said outlier score calculation step and calculating the moving average,

a second learning step of sequentially reading the moving average of the outlier score calculated by said moving average calculation step and learning the generation mechanism for the moving average series in the read score as a time-series statistic model

specified by the finite number of parameters, and
15 a change point score calculation step of reading
the parameter values obtained through learning by said
second learning step, calculating the outlier score of
each moving average based on the read parameter of the
time-series model and the moving average of the input
20 outlier scores and outputting the outlier score as the
change point score of the original data.

10. An outlier and change point detection method as
set forth in claim 9, wherein,
 in case the sequentially input data are described
with continuous variate only,
5 said learning step sequentially reads the data
string of the real number vector values and learns the
probability distribution for generation of said data
string using the autoregressive model, and updates the
sufficient statistic of the autoregressive model with
10 forgetting the past data using newly read data, reads
said updated sufficient statistic and calculates the
parameter of the autoregressive model using the
sufficient statistic.

11. An outlier and change point detection method as
set forth in claim 9, wherein
 said outlier score calculation step and said
change point score calculation step are considered as a

5 single score calculation step and further comprising:
 a step in which, as a method to determine
candidates of outliers and change points in the series
for the data series described with discrete and/or
continuous variates, the data are sorted in descending
10 order based on said calculated outlier score and the
change point score and the higher score data are
displayed as the outlier and change point candidates
according to the order of sorting.

12. An outlier and change point detection method as
set forth in claim 9, wherein

 said outlier score calculation step and said
change point score calculation step are considered as a
5 single score calculation step and further comprising a
step in which, as a method to determine outlier and
change point candidates in the series, the data over the
predetermined threshold selected from said calculated
outlier and change point scores as the candidates of
10 outliers or change points for the data described with
discrete variate sequentially input and/or continuous
variate.